

REMARKS

In response to the Office Action dated November 4, 2006, Applicant respectfully requests reconsideration.

Claims 1-8 were previously pending in this application. No claims are being amended or added by this amendment. As a result, claims 1-8 are pending for examination with claims 1 and 5 being independent claims. No new matter has been added.

Discussion of the Present Application

Conventional triacs used for medium-power bidirectional switches are controlled by the injection of current. To provide triacs that are voltage-controlled, triacs that include MOS structures have been developed, one example of which is described in U.S. Patent No. 5,608,235 to Pezzani ("Pezzani '235"). A triac that includes a MOS structure requires that certain manufacturing steps be performed to produce an insulated gate. Performance of these steps require a substantial modification to the triac manufacturing process.

Embodiments of the present invention are directed to a new type of triac which can be voltage-controlled without including a MOS structure. As described in the specification of the present application, in some embodiments, such as the embodiment shown in Figure 3, a voltage-controlled component of triac type includes a first region (6) and a second region (8), each of a first conductivity type, that are formed in a first well (5) of a second conductivity type. A pilot structure comprises a second well (11) of the second conductivity type and a third region (12) and a fourth region (13) of the first conductivity type. Also according to some embodiments, the pilot structure is above an extension (4) of a second main electrode.

According to one aspect of embodiments of the invention, by providing a second region of a first conductivity type in a first well and a pilot structure including on a front surface a second well containing first and second regions of a second conductivity type, voltage control of bidirectional switches can be achieved without necessarily using insulated gates.

Rejections Under 35 U.S.C. §103

Claims 1-8 were rejected under 35 U.S.C. §103(a) as being unpatentable over Pezzani '235 in view of U.S. Patent No. 6,034,381 to Pezzani ("Pezzani '381").

Pezzani '235 describes a voltage-controlled bidirectional switch which uses MOS transistors and, unlike some embodiments of the present invention, includes an insulated gate (see reference number 10 in Figures 4A and 5A and column 5, lines 64-64).

The Examiner asserts that Pezzani '235 discloses a voltage-controlled bidirectional switch that includes every claim limitation of each of independent claims 1 and 5 except for the recited extension of a second main electrode region of a second thyristor. To cure this deficiency, the Examiner contends that it would have been obvious to one of skill in the art to modify the device of Pezzani '235 to include the metallization/electrode extension that is described in Pezzani '381 in order to have a voltage-controlled bidirectional switch with increased performance. This rejection is respectfully traversed.

Motivation to Combine has not been Established

By contending that it would be obvious to modify the voltage-controlled device of Pezzani '235 with the electrode extension of the current-controlled device of Pezzani '381, the Examiner implies that the device of Pezzani '235 suffers from inferior performance that can be increased through modification according to the teachings of Pezzani '381. It is not explained in the Office Action how the modification of the device of Pezzani '235 would increase performance. A *prima facie* case of obviousness requires that there be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the teachings (see MPEP 2142). Applicants respectfully submit that the unsupported statement that it would have been obvious to combine to the two references because the electrode extension feature would increase performance of the device of Pezzani '235 does not provide a convincing line of reasoning or explain with reasonable specificity the contended motivation to combine the teachings. If the Examiner is to maintain the rejection, Applicants kindly request that the Examiner specifically point out the manner in which the teachings of Pezzani '381, which describes a current-controlled device, would increase the performance of the voltage-controlled device of Pezzani '235, and where the desirability of increasing the performance of Pezzani '235 in this specific manner can be found.

The Claims Patentably Distinguish Over the Combination of Pezzani '235 and Pezzani '381

Even if Pezzani '235 and Pezzani '381 were combined in the manner put forward the Office Action, which is not conceded, the claims still patentably distinguish over any such combination.

Claims 1-4

Claim 1 is directed to a voltage-controlled monolithic component of triac type, formed in a substrate of a first conductivity type, including, *inter alia*, a first region of a first conductivity type formed in a first well of a second conductivity type, the first well containing a second region of the first conductivity type, and a pilot structure on the front surface side, the pilot structure including a second well of the second conductivity type containing third and fourth regions of the first conductivity type, the third region and a portion of the second well being connected to a gate terminal, and the fourth region being connected to the second region.

Pezzani '235 does not teach or suggest each and every feature listed above. The device illustrated by Pezzani '235 in Figures 4A and 4B contains a first P-type well (2) and a second P-type well (3) (see col. 4, lines 4-6). The first P-type well (2) does not contain any N-type regions. Accordingly, Figures 4A and 4B do not teach first and second wells of a second conductivity type with each well having at least two regions of a first conductivity type.

Figures 5A and 5B of Pezzani '235 show a device containing a first P-type well (2) and second P-type well (3). Figures 5A and 5B do not show a pilot structure, on a front surface side, including a second well containing third and fourth regions of a first conductivity type, with the third region being connected to a gate terminal and the fourth region being connected to a second region of a first well. If N-type region (21) is assumed to be the third region recited in claim 1, then Pezzani '235 does not teach the third region recited in claim 1, which is required to be connected to a gate terminal. If N-type region (4) (which connects to a gate terminal (g) through an insulating gate layer 12) is assumed to be the third region recited in claim 1, then the only possible fourth region of first conductivity type would be the other N-type region of the second well, i.e., N-type region (21), and N-type region (21) is not connected to a second region of the first well (2). Claim 1 requires that the fourth region of the second well be connected to the second region of the first well. Accordingly, Pezzani '235 does not teach or suggest the pilot structure recited in claim 1.

Pezzani '381 does not cure this deficiency because each of the P-type wells shown in Pezzani '381 contain only one N-type region, and therefore does not teach or suggest first and

second wells of a second conductivity type with each well having at least two regions of a first conductivity type.

Because Pezzani '235 and Pezzani '381 do not teach or suggest a pilot structure, on the front surface side, including a third region of first conductivity type connected to a gate terminal and a fourth region connected to a second region of a first well, it is respectfully requested that the rejection of claim 1 be withdrawn. If the Examiner is to maintain the rejection, Applicants kindly request that the Examiner specifically point out where in Pezzani '235 a teaching of the above structure can be found.

Claim 1 also recites that the pilot structure is recited in claim 1 to be above an extension of a second main electrode region of a second thyristor.

As conceded in the Office Action, Pezzani '235 does not teach an extension of the electrode region. It is stated in the Office Action that Pezzani '381 discloses an extension region that is used for an electrode for second thyristor Th2. While Pezzani '381 does show a cathode region (6) of thyristor Th2 extending laterally, the P-type well that is connected to a gate terminal, that is, P-type well (10), is not shown to be above cathode region (6). Claim 1 requires a pilot structure, which includes a region connected to a gate terminal, to be above an extension of a second main electrode. The only region connected to a gate terminal in Pezzani '381 is N-type region (11), and thus the only possible pilot structure includes P-type well (10), which is not shown to be above the cathode region (6). Accordingly, neither Pezzani '235 nor Pezzani '381 teaches or suggests a pilot structure that is above an extension of a second main electrode region of a second thyristor, wherein the pilot structure includes a second well which includes a third region and a fourth region, with a portion of the second well and the third region being connected to a gate terminal. For at least this reason, the rejection of claim 1 is respectfully requested to be withdrawn.

Claims 2-4 depend from claim 1 and patentably distinguish over any combination of Pezzani '235 and Pezzani '381 for at least the same reasons provided above for claim 1, and it is respectfully requested that these rejections be withdrawn.

Claims 5-8

Claim 5 is directed to a voltage-controlled monolithic component of triac type, formed in a substrate of a first conductivity type, comprising, *inter alia*, a first well of a second conductivity type comprising a first and second region of the first conductivity type, and a pilot structure

comprising a second well of the second conductivity type and a third and fourth region of the first conductivity type. Claim 5 further recites that the third region and a portion of the second well are connected to a gate terminal, and the second region and the fourth region are connected.

As should be appreciated from the above discussion relating to claim 1, neither of the applied references teaches or suggests a pilot structure comprising a second well of a second conductivity type and third and fourth regions of a first conductivity type, wherein the third region is connected to a gate terminal, and wherein the fourth region is connected to a second region of a first well. For at least this reason, it is respectfully requested that the rejection of claim 5 be withdrawn.

The component recited in claim 5 also comprises a first thyristor and a second thyristor, the second thyristor comprising a first main electrode corresponding to the first well, wherein an extension of a second main electrode of the second thyristor is located below the pilot structure. Claim 5 also recites that the third region and a portion of the second well of the pilot structure are connected to a gate terminal.

As discussed above regarding claim 1, the only possible pilot structure in Pezzani '381 includes P-type well (10), and cathode region (6) is not shown to be below P-type well (10). Accordingly, neither Pezzani '235 nor Pezzani '381 teaches or suggests a an extension of a second main electrode region of a second thyristor that is below a pilot structure, wherein the pilot structure comprises a second well and a third region and a fourth region, with a portion of the second well and the third region being connected to a gate terminal. For at least this reason, the rejection of claim 5 is respectfully requested to be withdrawn.

Claims 6-8 depend from claim 5 and patentably distinguish over any combination of Pezzani '235 and Pezzani '381 for at least the same reasons as claim 5, and it is respectfully requested that these rejections be withdrawn.

CONCLUSION

In view of the above remarks, the pending application is believed to be in condition for allowance.


A Notice of Allowance is respectfully requested. The Examiner is requested to call the undersigned at the telephone number listed below if this communication does not place the case in condition for allowance.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, any necessary extension of time is hereby requested. If there is a fee occasioned by this response, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 23/2825.

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Respectfully submitted,

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